

## Claims

- [1] 1. A carbon body having an aluminium-wettable outer part that is made of a carbon-rich mixture containing metal-based particles and carbon, the metal-based particles being made of metal oxide particles and/or partly oxidised metal particles or a precursor thereof, the metal of the metal-based particles being selected from iron, copper, cobalt, nickel, zinc and manganese and combinations thereof, the metal oxide particles and/or partly oxidised metal particles being reactable with molten aluminium when exposed thereto to form a mixture of: aluminium oxide; the metal of said metal-based particles; and aluminium.
2. The body of claim 1, which comprises an inner part that is substantially free of metal-based particles, and wherein said outer part has a thickness of 5 to 50 mm, in particular from 10 to 25 mm.
3. The body of claim 1, which comprises metal-based particles throughout.
4. The body of any preceding claim, wherein the metal-based particles are impregnated into the carbon body.
5. The body of claim 4, wherein the carbon and the metal-based particles in the outer part are present in a weight ratio metal-based particles/carbon from 1/100 to 1/20, in particular from 1/50 to 1/25.
6. The body of any one of claims 1 to 3, wherein the outer part is made of a heat treated mixture of the metal-based particles and particles of carbon.
7. The body of claim 6, wherein the carbon and the metal-based particles of the outer part are present in a weight ratio metal-based particles/carbon from 1/20 to 1/2, in particular from 1/8 to 1/4.
8. The body of any preceding claim, wherein the outer part of the carbon body comprises further particles of at least one additional metal compound.
9. The body of claim 8, wherein said at least one additional metal compound is selected from refractory borides, silicides, nitrides, carbides, phosphides, oxides, aluminides, metal alloys, intermetallics, and mixtures thereof, of titanium, zirconium, hafnium, vanadium, silicon, niobium, tantalum and molybdenum.
10. The body of claim 8 or 9, wherein said further particles and said metal-based particles of the outer part are present in a weight ratio further particles/metal-based particles from 1/10 to 1/2.
11. The body of any preceding claim, wherein the metal-based particles are present in the outer part in an organic carrier, in particular selected from pitch, polyurethane, ethylene glycol, polyethylene glycol, resins, esters or waxes.
12. The body of any preceding claim, wherein the metal-based particles are present in the outer part in an inorganic carrier, in particular selected from

colloidal and/or polymeric metal compounds of metals selected from aluminium, silicon, yttrium, cerium, thorium, zirconium, tin, nickel, iron, chromium and magnesium which compounds form a metal oxide binder upon heat treatment.

13. The body of any preceding claim, comprising an aluminium-wettable top coating which is free or substantially free of elemental carbon and organic carbon compounds.

14. A carbon body having an aluminium-wetted outer part producible by exposing the body of any preceding claim to molten aluminium, the outer part comprising a carbon-rich mixture containing: aluminium oxide; the metal of said metal-based particles; and aluminium.

15. A method of manufacturing a carbon body comprising:

- providing a mass of carbon;
- providing metal-based particles made of metal oxide particles and/or partly oxidised metal particles or a heat-convertible precursor thereof, the metal of the metal-based particles being selected from iron, copper, cobalt, nickel, zinc, manganese and silicon and combinations thereof, the metal oxide particles and/or partly oxidised metal particles being reactable with molten aluminium when exposed thereto to form a mixture of: aluminium oxide; the metal of said metal-based particles; and aluminium;
- adding the metal-based particles into the mass of carbon so as to form a carbon-rich mixture containing the metal-based particles; and
- consolidating by heat treatment the metal-based particles in the carbon mass to form an aluminium-wettable outer part of the carbon body which outer part is made of a carbon-rich mixture containing the metal-based particles.

16. The method of claim 15, wherein the metal-based particles are impregnated into the outer part of the carbon body that forms the carbon mass, the metal-based particles being then consolidated in the carbon body's outer part by heat treatment.

17. The method of claim 16, wherein the metal-based particles are impregnated into the outer part of the carbon body in ionic, polymeric and/or colloidal form.

18. The method of claim 15, wherein the metal-based particles are mixed with carbon particles that form the carbon mass, the mixed carbon particles and metal-based particles being then consolidated by heat treatment to form the outer part of the carbon body.

19. The method of claim 18, wherein a layer of the carbon particles and the metal-based particles is consolidated on a substrate.

20. The method of claim 19, wherein said layer is consolidated on a baked carbon substrate.

21. The method of claim 19, wherein the substrate is a non-baked or part-baked carbon substrate, said layer and substrate being consolidated together by heat treatment.
22. The method of claim 21, wherein the substrate and the layer of the particle mixture are formed by co-extrusion followed by heat treatment.
23. The method of claim 18, wherein the carbon particles and the metal-based particles are consolidated to form a self-sustaining body.
24. The method of any one of claims 14 to 23, comprising adding into the mass of carbon further particles of at least one additional metal compound.
25. The method of claim 24, wherein said at least one additional metal compound is selected from refractory borides, silicides, nitrides, carbides, phosphides, oxides, aluminides, metal alloys, intermetallics, and mixtures thereof, of titanium, zirconium, hafnium, vanadium, silicon, niobium, tantalum and molybdenum, and precursors thereof.
26. The method of claim 24 or 25, wherein said further particles are provided in a mixture with said metal-based particles which is added into the carbon mass.
27. The method of any one of claim 14 to 26, wherein the metal-based particles are provided in a liquid carrier.
28. The method of claim 27, wherein the liquid carrier comprises an organic carrier, in particular selected from pitch, polyurethane, ethylene glycol, polyethylene glycol, resins, esters or waxes.
29. The method of claim 27 or 28, wherein the liquid carrier comprises an inorganic carrier, in particular selected from colloidal and/or polymeric metal compounds of metals selected from aluminium, silicon, yttrium, cerium, thorium, zirconium, tin, nickel, iron, chromium and magnesium which compounds form a metal oxide binder upon heat treatment.
30. The method of any one of claims 14 to 29, comprising applying onto the metal-based particle-containing outer part of the carbon body, an aluminium-wettable top coating which is free or substantially free of elemental carbon and organic carbon compounds.
31. The method of any one of claims 14 to 30, comprising exposing the aluminium-wettable outer part to molten aluminium to react said metal-based particles with molten aluminium and wet the outer part by aluminium.
32. A carbon-rich particle mixture for forming upon heat treatment a self-sustaining body or a layer of carbon that contains metal oxide and/or partly oxidised metal, the particle mixture comprising carbon particles and metal-based particles made of a metal oxide and/or a partly oxidised metal or a precursor thereof, the metal from the metal-based particles being selected from iron,

copper, cobalt, nickel, zinc and manganese and combinations thereof, the metal-based particles being reactable with molten aluminium when exposed thereto to form a mixture of: aluminium oxide; the metal of said metal-based particles; and aluminium.

33. A component of an apparatus that during use contains molten aluminium, the component comprising a body as defined in any one of claims 1 to 13.

34. An apparatus that during use contains molten aluminium, and having a component as defined in claim 33.

35. The apparatus of claim 34, which is a cell for the electrowinning of aluminium, said component being part of a cathode, a cell bottom or a sidewall.

36. The apparatus of claim 34, which is an apparatus for treating molten aluminium, said component being exposed during use to molten aluminium.

37. A method of operating an apparatus as defined in any one of claims 34 to 36, wherein during operation said component is exposed to molten aluminium.

38. The method of claim 37, wherein the apparatus is an aluminium electrowinning cell, said method comprising electrowinning aluminium which comes into contact with said component.

39. The method of claim 37, wherein the apparatus is an apparatus for treating molten aluminium, said method comprising treating molten aluminium which comes into contact with said component.